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Positive polynomials and numerical approximation

Abstract

The design of high order methods with strong control of the maximum principle is still a core problem in scientific computing. That is why a natural theoretical question is to have good representations of polynomial with bounds. This topic ranges from scientific computing and numerical analysis to convex analysis and purely algebraic considerations. I will describe recent ideas based the Lukacs Theorem and algebraic representations as some of squares (SOS): it results in new efficient Newton-Raphson and convex algorithms for calculations of SOS. The case of polynomial with two bounds can be treated with a (surprising) quaternion algebra. An application to the discretization of the transport equation will be described.